

CLAIMS

What is claimed is:

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1. In a computer, a method for obtaining resource usage information from a node of a network, the method comprising the steps of:
- generating, for a data element, a value for a parameter within the data element that will cause the node of the network to determine that the data element is stale when the node of the network receives the data element;
- 10 sending the data element to the node of the network; and
- receiving a signal from the node of the network, the signal including (i) an indication that the node of the network has removed the data element from the network, and (ii) resource usage information describing usage of resources within the node of the network.
- 15 2. The method of claim 1 wherein the node of the network (i) includes multiple resources and (ii) is capable of processing non-stale data elements using different combinations of the multiple resources, and wherein the step of receiving includes the step of:
- 20 acquiring, as the resource usage information, a history which identifies a combination of the multiple resources that processed the data element as a non-stale data element.

3. The method of claim 1 wherein the parameter within the data element is a Time-To-Live field, the contents of which identify a limit to the number of remaining nodes which can process the data element within the network, wherein the signal is an Internet Control Message Protocol error message, and wherein the step of receiving includes the step of:

acquiring, as the indication that the node of the network has removed the data element from the network, a notification that the limit to the number of remaining nodes which can process the data element within the network has been reached.

4. The method of claim 1 wherein the computer includes a database, and wherein the method further comprises the step of:

extracting the resource usage information from the signal;

updating contents of the database with the extracted resource usage information; and

tuning the node of the network based on the updated contents of the database.

5. An apparatus for obtaining resource usage information from a node of a network, comprising:

a network interface for connecting to the network; and

a controller coupled to the network interface, the controller being

5 configured to:

generate, for a data element, a value for a parameter within the data element that will cause the node of the network to determine that the data element is stale when the node of the network receives the data element,

10 send the data element to the node of the network through the network interface, and

receive a signal from the node of the network, the signal including (i) an indication that the node of the network has removed the data element from the network, and (ii) resource usage information describing usage of resources within the node of the network.

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6. The apparatus of claim 5 wherein the node of the network (i) includes multiple resources and (ii) is capable of processing non-stale data elements using different combinations of the multiple resources, and wherein the controller includes:

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circuitry that acquires, as the resource usage information, a history which identifies a combination of the multiple resources that processed the data element as a non-stale data element.

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7. The apparatus of claim 5 wherein the parameter within the data element is a Time-To-Live field, the contents of which identify a limit to the number of remaining nodes which can process the data element within the network, wherein the signal is an Internet Control Message Protocol error message, and wherein the controller includes:

5 circuitry that acquires, as the indication that the node of the network has removed the data element from the network, a notification that the limit to the number of remaining nodes which can process the data element within the network has been reached.

- 10 8. The apparatus of claim 5 further comprising:

a memory, coupled to the controller, which stores a database, wherein the controller is configured to:

15 extract the resource usage information from the signal;

update contents of the database with the extracted resource usage information; and

tune the node of the network through the network interface based on the updated contents of the database.

9. A computer program product that includes a computer readable medium having instructions stored thereon for obtaining resource usage information from a node of a network, such that the instructions, when carried out by the computer, cause the computer to perform the steps of:
- 5 generating, for a data element, a value for a parameter within the data element that will cause the node of the network to determine that the data element is stale when the node of the network receives the data element;
- sending the data element to the node of the network; and
- receiving a signal from the node of the network, the signal including (i) an
- 10 indication that the node of the network has removed the data element from the network, and (ii) resource usage information describing usage of resources within the node of the network.
10. The computer program product of claim 9 wherein the node of the network (i)
- 15 includes multiple resources and (ii) is capable of processing non-stale data elements using different combinations of the multiple resources, and wherein the step of receiving includes the step of:
- acquiring, as the resource usage information, a history which identifies a combination of the multiple resources that processed the data element as a
- 20 non-stale data element.

11. In a node of a network, a method for providing resource usage information, the method comprising the steps of:
- receiving a data element from a source computer of the network;
 - determining that the data element is stale based on a parameter within the data element; and
 - removing the data element from the network and sending a signal to the source computer of the network, the signal including (i) an indication that the node of the network has removed the data element from the network, and (ii) resource usage information describing usage of resources within the node of the network.
12. The method of claim 11 wherein the node of the network (i) includes multiple resources and (ii) is capable of processing non-stale data elements using different combinations of the multiple resources, and further comprising the steps of:
- after the step of determining, processing the data element as a non-stale data element using a combination of the multiple resources; and
 - generating, as the resource usage information, a history which identifies the combination of the multiple resources that processed the data element as a non-stale data element.

13. The method of claim 11 wherein the parameter within the data element is a Time-To-Live field, the contents of which identify a limit to the number of remaining nodes which can process the data element within the network, wherein the step of determining includes the step of:
- 5 updating a value defined by the contents of the Time-To-Live field of the data element to determine that the limit to the number of remaining nodes which can process the data element within the network has been reached, and
- wherein the step of removing and sending includes the step of:
- 10 providing as the signal to the source computer of the network, an Internet Control Message Protocol error message.
14. The method of claim 11 wherein the node of the network is capable of processing data elements based on a tuning attribute, and wherein the method further
- 15 comprises the steps of:
- receiving, from the source computer, a tuning command based on the resource usage information; and
- adjusting the tuning attribute based on the tuning command in order to change a manner in which the node processes data elements.

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A network node for providing resource usage information, comprising:
a network interface for connecting to the network;
a controller coupled to the network interface, the controller being
configured to:

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receive a data element from a source computer of the
network through the network interface;

determine that the data element is stale based on a
parameter within the data element; and

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remove the data element from the network and send a
signal to the source computer of the network through the network
interface, the signal including (i) an indication that the node of the
network has removed the data element from the network, and (ii)
resource usage information describing usage of resources within
the node of the network.

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16. The network node of claim 15 wherein the controller includes:

multiple resources; and

a control module, coupled to the multiple resources, which is capable of
processing non-stale data elements using different combinations of the multiple
resources, the control module being configured to:

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process the data element as a non-stale data element using a
combination of the multiple resources, and

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generate, as the resource usage information, a history which
identifies the combination of the multiple resources that processed
the data element as a non-stale data element.

17. The network node of claim 15 wherein the parameter within the data element is a Time-To-Live field, the contents of which identify a limit to the number of remaining nodes which can process the data element within the network, and wherein the controller includes:

5 circuitry that (i) updates a value defined by the contents of the Time-To-Live field of the data element to determine that the limit to the number of remaining nodes which can process the data element within the network has been reached, and (ii) provides, as the signal to the source computer of the network, an Internet Control Message Protocol error message.

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18. The network node of claim 15 wherein the controller is capable of processing data elements based on a tuning attribute, and wherein the controller includes:

15 circuitry that (i) receives, from the source computer through the network interface, a tuning command based on the resource usage information, and (ii) adjusts the tuning attribute based on the tuning command in order to change a manner in which the controller processes data elements.

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19. A computer program product that includes a computer readable medium having instructions stored thereon for providing resource usage information, such that the instructions, when carried out by the computer, cause the computer to perform the steps of:

5 receiving a data element from a source computer of the network;
determining that the data element is stale based on a parameter within the data element; and
removing the data element from the network and send a signal to the source computer of the network, the signal including (i) an indication that the
10 node of the network has removed the data element from the network, and (ii) resource usage information describing usage of resources within the node of the network.

20. The computer program product of claim 19 wherein the node of the network (i)
15 includes multiple resources and (ii) is capable of processing non-stale data elements using different combinations of the multiple resources, and wherein the instruction further cause the computer to perform the steps of:

after the step of determining, processing the data element as a non-stale data element using a combination of the multiple resources; and
20 generating, as the resource usage information, a history which identifies the combination of the multiple resources that processed the data element as a non-stale data element.

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21. A system for obtaining resource usage information, comprising:
a source computer which provides a data element; and
a network node, coupled to the source computer, which forms at least a
portion of a network with the source computer, the network node being configured
to:

receive the data element from the source computer;
determine that the data element is stale based on a
parameter within the data element; and
remove the data element from the network and send a
signal to the source computer, the signal including (i) an indication
that the network node has removed the data element from the
network, and (ii) resource usage information describing usage of
resources within the network node.

22. The system of claim 21 wherein the network node includes:
multiple resources; and
a control module, coupled to the multiple resources, which is capable of
processing non-stale data elements using different combinations of the multiple
resources, the control module being configured to:
process the data element provided by the source computer
as a non-stale data element using a combination of the multiple
resources; and
generate, as the resource usage information, a history which
identifies the combination of the multiple resources that processed
the data element as a non-stale data element.

23. The system of claim 21 wherein the parameter within the data element is a Time-To-Live field, the contents of which identify a limit to the number of remaining nodes which can process the data element within the network, and wherein the network node includes:

5 circuitry that (i) updates a value defined by the contents of the Time-To-Live field of the data element to determine that the limit to the number of remaining nodes which can process the data element within the network has been reached, and (ii) provides, as the signal to the source computer of the network, an Internet Control Message Protocol error message.

10 24. The system of claim 21 wherein the source computer includes:

 a memory which stores a database; and

 a controller, coupled to the memory, which is configured to:

15 extract the resource usage information from the signal,
 update contents of the database with the extracted resource
 usage information, and
 generate a tuning command based on the updated contents
 of the database, and send the tuning command to the network node;
 and

20 wherein the network node is capable of processing data elements based on a tuning attribute, and wherein the network node includes:

 circuitry that (i) receives, from the source computer, the
 tuning command, and (ii) adjusts the tuning attribute based on the
 tuning command in order to change a manner in which the network
25 node processes data elements.

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